

CLAIMS

What Is Claimed Is:

1. A method for making a dental restoration comprising:
forming a model of one or more teeth;
coating the model with metal or alloy powder;
applying a covering material onto the model coated with metal or alloy powder
wherein the covering material is applied at a thickness equal to or less than about 8 mm and
wherein the covering material comprises a mixture of refractory powder and fibers;
sintering the model coated with metal or alloy powder and covering material in a
furnace to form a coping; and
removing the covering material from the coping.
2. The method of claim 1 wherein the fibers are selected from the group
consisting of inorganic, organic fibers and mixtures thereof.
3. The method of claim 2 wherein the inorganic fibers are selected from the
group consisting of glass, glass-ceramic, ceramic, metal and mixtures thereof.
4. The method of claim 3 wherein the glass fibers are selected from the group
consisting of E glass, S glass, AR glass and mixtures thereof.
5. The method of claim 3 wherein the ceramic fibers are selected from the group
consisting of alumina, mullite, silica, rock wool and mixtures thereof.
6. The method of claim 3 wherein the metal fibers are selected from the group
consisting of steel, aluminum and mixtures thereof.
7. The method of claim 2 wherein the organic fibers are selected from the group

consisting of carbon, polyester, polyolefin, polyetheramide, fluoropolymer, polyether, cellulose, phenolic, polyesteramide, polyurethane, epoxy, aminoplastic, silicone, polysulfone, polyetherketone, polyetheretherketone, polyesterimide, polyphenylene sulfide, polyether acryl ketone, poly(amideimide), polyimide fibers and mixtures thereof.

8. The method of claim 1 wherein the fibers range from about 0.1 to about 3 mm in length and from about 1 to about 100 microns in diameter.

9. The method of claim 1 wherein the fibers are present in an amount of from about 0.1 to about 25 percent by weight and the refractory powder is present in an amount of from about 75 to about 99.9 percent by weight of the total powder mixture.

10. The method of claim 1 wherein the refractory powder comprises a refractory die material.

11. The method of claim 1 wherein the covering material further comprises a liquid vehicle.

12. The method of claim 11 wherein the liquid vehicle is selected from alcohol and acetone.

13. The method of claim 1 further comprising coating the covering material with a high temperature refractory material.

14. The method of claim 1 wherein the refractory powder comprises silica, leucite or mixtures thereof.

15. The method of claim 14 wherein the silica is selected from the group consisting of quartz, cristobolite and mixtures thereof.

16. The method of claim 11 wherein the refractory die material is selected from the group consisting of gypsum-bonded, phosphate-bonded, ethyl silicate-bonded and mixtures thereof.

17. The method of claim 1 further comprising applying a die spacer material to the model prior to application of the metal or alloy powder.

18. The method of claim 1 wherein applying the covering material onto the model coated with metal or alloy powder comprises painting the covering material onto the metal powder with a brush.

19. The method of claim 13 wherein coating the covering material with a high temperature refractory material comprises dusting the high temperature refractory material onto the covering material.

20. A dental restoration formed by the process of claim 1.

21. A method for making a dental restoration comprising:
forming a model of one or more teeth;
coating the model with metal or alloy powder;
covering the model coated with metal powder with a covering material wherein the covering material comprises a mixture of refractory powder and fibers;
allowing the metal powder and covering material to dry to form a unit;
removing the dried metal powder and covering material unit from the model;
filling the understructure of the unit with covering material wherein the covering material comprises a mixture of refractory powder and fibers;
sintering the unit in a furnace to form a coping; and
removing the covering material from the coping.

22. The method of claim 21 wherein the fibers are selected from the group consisting of inorganic, organic fibers and mixtures thereof.

23. The method of claim 22 wherein the inorganic fibers are selected from the group consisting of glass, glass-ceramic, ceramic, metal and mixtures thereof.

24. The method of claim 23 wherein the glass fibers are selected from the group consisting of E glass, S glass, AR glass and mixtures thereof.

25. The method of claim 23 wherein the ceramic fibers are selected from the group consisting of alumina, mullite, silica, rock wool and mixtures thereof.

26. The method of claim 23 wherein the metal fibers are selected from the group consisting of steel, aluminum and mixtures thereof.

27. The method of claim 22 wherein the organic fibers are selected from the group consisting of carbon, polyester, polyolefin, polyetheramide, fluoropolymer, polyether, cellulose, phenolic, polyesteramide, polyurethane, epoxy, aminoplastic, silicone, polysulfone, polyetherketone, polyetheretherketone, polyesterimide, polyphenylene sulfide, polyether acryl ketone, poly(amideimide), polyimide fibers and mixtures thereof.

28. The method of claim 21 wherein the fibers range from about 10 nm to about 3 mm in length and from about 5 nm to about 100 microns in diameter.

29. The method of claim 21 wherein the fibers are present in an amount of from about 0.1 to about 25 percent by weight and the refractory powder is present in an amount of from about 75 to about 99.9 percent by weight of the total powder mixture.

30. The method of claim 21 wherein the refractory powder comprises a refractory die material.

31. The method of claim 21 wherein the covering material further comprises a liquid vehicle.

32. The method of claim 31 wherein the liquid vehicle is selected from alcohol and acetone.

33. The method of claim 21 further comprising coating the covering material with a high temperature refractory material.

34. The method of claim 21 wherein the refractory powder comprises silica, leucite or mixtures thereof.

35. The method of claim 34 wherein the silica is selected from the group consisting of quartz, cristobolite and mixtures thereof.

36. The method of claim 30 wherein the refractory die material is selected from the group consisting of gypsum-bonded, phosphate-bonded, ethyl silicate-bonded and mixtures thereof.

37. The method of claim 21 further comprising applying a die spacer material to the model prior to application of the metal or alloy powder.

38. The method of claim 21 wherein applying the covering material onto the model coated with metal or alloy powder comprises painting the covering material onto the metal powder with a brush.

39. The method of claim 33 wherein coating the covering material with a high temperature refractory material comprises dusting the high temperature refractory material onto the covering material.

40. A dental restoration formed by the process of claim 21.

41. A method for making a dental restoration comprising:

forming a model of one or more teeth;

coating the model with powder of a first metal or alloy;

placing a reservoir of a second metal or alloy onto the model coated with the powder of the first metal or alloy, wherein the second metal or alloy has a fusing temperature lower than the fusing temperature of the first metal or alloy;

covering the model coated with the powder of first metal or alloy and the reservoir of the second metal or alloy with covering material wherein the covering material comprises a mixture of refractory powder and fibers; and

sintering the model to form a coping.

42. The method of claim 41 wherein the fibers are selected from the group consisting of inorganic, organic fibers and mixtures thereof.

43. The method of claim 42 wherein the inorganic fibers are selected from the group consisting of glass, glass-ceramic, ceramic, metal and mixtures thereof.

44. The method of claim 43 wherein the glass fibers are selected from the group consisting of E glass, S glass, AR glass and mixtures thereof.

45. The method of claim 43 wherein the ceramic fibers are selected from the group consisting of alumina, mullite, silica, rock wool and mixtures thereof.

46. The method of claim 43 wherein the metal fibers are selected from the group consisting of steel, aluminum and mixtures thereof.

47. The method of claim 42 wherein the organic fibers are selected from the group consisting of carbon, polyester, polyolefin, polyetheramide, fluoropolymer, polyether, cellulose, phenolic, polyesteramide, polyurethane, epoxy, aminoplastic, silicone, polysulfone, polyetherketone, polyetheretherketone, polyesterimide, polyphenylene sulfide, polyether acryl ketone, poly(amideimide), polyimide fibers and mixtures thereof.

48. The method of claim 41 wherein the fibers range from about 10 nm to about 3 mm in length and from about 5 nm to about 100 microns in diameter.

49. The method of claim 41 wherein the fibers are present in an amount of from about 0.1 to about 25 percent by weight and the refractory powder is present in an amount of from about 75 to about 99.9 percent by weight of the total powder mixture.

50. The method of claim 41 wherein the refractory powder comprises a refractory die material.

51. The method of claim 41 wherein the covering material further comprises a liquid vehicle.

52. The method of claim 51 wherein the liquid vehicle is selected from alcohol and acetone.

53. The method of claim 41 further comprising coating the covering material with a high temperature refractory material.

54. The method of claim 41 wherein the refractory powder comprises silica,

leucite or mixtures thereof.

55. The method of claim 54 wherein the silica is selected from the group consisting of quartz, cristobolite and mixtures thereof.

56. The method of claim 50 wherein the refractory die material is selected from the group consisting of gypsum-bonded, phosphate-bonded, ethyl silicate-bonded and mixtures thereof.

57. The method of claim 41 further comprising applying a die spacer material to the model prior to application of the metal or alloy powder.

58. The method of claim 41 wherein applying the covering material onto the model coated with metal or alloy powder comprises painting the covering material onto the metal powder with a brush.

59. The method of claim 53 wherein coating the covering material with a high temperature refractory material comprises dusting the high temperature refractory material onto the covering material.

60. A dental restoration formed by the process of claim 41.

61. A method for making a dental restoration comprising:
forming a model of one or more teeth, wherein the model comprises a margin area;
coating the model with powder of a metal or alloy to a point above the margin area;
covering the model coated with powder with a covering material wherein the covering material comprises a mixture of refractory powder and fibers;
sintering the model coated with powder in a furnace to form a metal coping;
removing the covering material from the metal coping;

applying a first porcelain material on the metal coping;
applying a second porcelain material on the model along the margin area; and
firing the coping and die coated with first and second porcelain material in a furnace.

62. The method of claim 61 wherein the fibers are selected from the group consisting of inorganic, organic fibers and mixtures thereof.

63. The method of claim 62 wherein the inorganic fibers are selected from the group consisting of glass, glass-ceramic, ceramic, metal and mixtures thereof.

64. The method of claim 63 wherein the glass fibers are selected from the group consisting of E glass, S glass, AR glass and mixtures thereof.

65. The method of claim 63 wherein the ceramic fibers are selected from the group consisting of alumina, mullite, silica, rock wool and mixtures thereof.

66. The method of claim 63 wherein the metal fibers are selected from the group consisting of steel, aluminum and mixtures thereof.

67. The method of claim 62 wherein the organic fibers are selected from the group consisting of carbon, polyester, polyolefin, polyetheramide, fluoropolymer, polyether, cellulose, phenolic, polyesteramide, polyurethane, epoxy, aminoplastic, silicone, polysulfone, polyetherketone, polyetheretherketone, polyesterimide, polyphenylene sulfide, polyether acryl ketone, poly(amideimide), polyimide fibers and mixtures thereof.

68. The method of claim 61 wherein the fibers range from about 10 nm to about 3 mm in length and from about 5 nm to about 100 microns in diameter.

69. The method of claim 61 wherein the fibers are present in an amount of from

about 0.1 to about 25 percent by weight and the refractory powder is present in an amount of from about 75 to about 99.9 percent by weight of the total powder mixture.

70. The method of claim 61 wherein the refractory powder comprises a refractory die material.

71. The method of claim 61 wherein the covering material further comprises a liquid vehicle.

72. The method of claim 71 wherein the liquid vehicle is selected from alcohol and acetone.

73. The method of claim 61 further comprising coating the covering material with a high temperature refractory material.

74. The method of claim 61 wherein the refractory powder comprises silica, leucite or mixtures thereof.

75. The method of claim 74 wherein the silica is selected from the group consisting of quartz, cristobolite and mixtures thereof.

76. The method of claim 70 wherein the refractory die material is selected from the group consisting of gypsum-bonded, phosphate-bonded, ethyl silicate-bonded and mixtures thereof.

77. The method of claim 61 further comprising applying a die spacer material to the model prior to application of the metal or alloy powder.

78. The method of claim 61 wherein applying the covering material onto the

model coated with metal or alloy powder comprises painting the covering material onto the metal powder with a brush.

79. The method of claim 73 wherein coating the covering material with a high temperature refractory material comprises dusting the high temperature refractory material onto the covering material.

80. A dental restoration formed by the process of claim 61.

81. A method for making a dental restoration comprising:
forming a model of one or more teeth;
placing a bar or pontic on the model;
coating the model and bar or pontic with metal or alloy powder;
applying a covering material onto the model coated with metal or alloy powder
wherein the covering material comprises a mixture of refractory powder and fibers;
sintering the model coated with metal or alloy powder and covering material in a furnace to form a coping; and
removing the covering material from the coping.

82. The method of claim 81 wherein the fibers are selected from the group consisting of inorganic, organic fibers and mixtures thereof.

83. The method of claim 82 wherein the inorganic fibers are selected from the group consisting of glass, glass-ceramic, ceramic, metal and mixtures thereof.

84. The method of claim 83 wherein the glass fibers are selected from the group consisting of E glass, S glass, AR glass and mixtures thereof.

85. The method of claim 83 wherein the ceramic fibers are selected from the

group consisting of alumina, mullite, silica, rock wool and mixtures thereof.

86. The method of claim 83 wherein the metal fibers are selected from the group consisting of steel, aluminum and mixtures thereof.

87. The method of claim 82 wherein the organic fibers are selected from the group consisting of carbon, polyester, polyolefin, polyetheramide, fluoropolymer, polyether, cellulose, phenolic, polyesteramide, polyurethane, epoxy, aminoplastic, silicone, polysulfone, polyetherketone, polyetheretherketone, polyesterimide, polyphenylene sulfide, polyether acryl ketone, poly(amideimide), polyimide fibers and mixtures thereof.

88. The method of claim 81 wherein the fibers range from about 10 nm to about 3 mm in length and from about 5 nm to about 100 microns in diameter.

89. The method of claim 81 wherein the fibers are present in an amount of from about 0.1 to about 25 percent by weight and the refractory powder is present in an amount of from about 75 to about 99.9 percent by weight of the total powder mixture.

90. The method of claim 81 wherein the refractory powder comprises a refractory die material.

91. The method of claim 81 wherein the covering material further comprises a liquid vehicle.

92. The method of claim 91 wherein the liquid vehicle is selected from alcohol and acetone.

93. The method of claim 81 further comprising coating the covering material with a high temperature refractory material.

94. The method of claim 81 wherein the refractory powder comprises silica, leucite or mixtures thereof.

95. The method of claim 94 wherein the silica is selected from the group consisting of quartz, cristobolite and mixtures thereof.

96. The method of claim 90 wherein the refractory die material is selected from the group consisting of gypsum-bonded, phosphate-bonded, ethyl silicate-bonded and mixtures thereof.

97. The method of claim 81 further comprising applying a die spacer material to the model prior to application of the metal or alloy powder.

98. The method of claim 81 wherein applying the covering material onto the model coated with metal or alloy powder comprises painting the covering material onto the metal powder with a brush.

99. The method of claim 81 wherein coating the covering material with a high temperature refractory material comprises dusting the high temperature refractory material onto the covering material.

100. A dental restoration formed by the process of claim 81.

101. A method for making a dental restoration comprising:
forming a model of one or more teeth;
coating the model with powder of a first metal or alloy;
attaching a sprue to the model coated with the powder of the first metal or alloy;
attaching a reservoir of a second metal or alloy onto the sprue, wherein the second

metal or alloy has a fusing temperature lower than the fusing temperature of the first metal or alloy;

covering the model coated with the powder of the first metal or alloy and the mass of the second metal or alloy with covering material, wherein the covering material comprises a mixture of refractory powder and fibers; and

sintering the model.

102. The method of claim 101 wherein the fibers are selected from the group consisting of inorganic, organic fibers and mixtures thereof.

103. The method of claim 102 wherein the inorganic fibers are selected from the group consisting of glass, glass-ceramic, ceramic, metal and mixtures thereof.

104. The method of claim 103 wherein the glass fibers are selected from the group consisting of E glass, S glass, AR glass and mixtures thereof.

105. The method of claim 103 wherein the ceramic fibers are selected from the group consisting of alumina, mullite, silica, rock wool and mixtures thereof.

106. The method of claim 103 wherein the metal fibers are selected from the group consisting of steel, aluminum and mixtures thereof.

107. The method of claim 102 wherein the organic fibers are selected from the group consisting of carbon, polyester, polyolefin, polyetheramide, fluoropolymer, polyether, cellulose, phenolic, polyesteramide, polyurethane, epoxy, aminoplastic, silicone, polysulfone, polyetherketone, polyetheretherketone, polyesterimide, polyphenylene sulfide, polyether acryl ketone, poly(amideimide), polyimide fibers and mixtures thereof.

108. The method of claim 101 wherein the fibers range from about 10 nm to about

3 mm in length and from about 5 nm to about 100 microns in diameter.

109. The method of claim 101 wherein the fibers are present in an amount of from about 0.1 to about 25 percent by weight and the refractory powder is present in an amount of from about 75 to about 99.9 percent by weight of the total powder mixture.

110. The method of claim 101 wherein the refractory powder comprises a refractory die material.

111. The method of claim 101 wherein the covering material further comprises a liquid vehicle.

112. The method of claim 111 wherein the liquid vehicle is selected from alcohol and acetone.

113. The method of claim 101 further comprising coating the covering material with a high temperature refractory material.

114. The method of claim 101 wherein the refractory powder comprises silica, leucite or mixtures thereof.

115. The method of claim 114 wherein the silica is selected from the group consisting of quartz, cristobolite and mixtures thereof.

116. The method of claim 110 wherein the refractory die material is selected from the group consisting of gypsum-bonded, phosphate-bonded, ethyl silicate-bonded and mixtures thereof.

117. The method of claim 101 further comprising applying a die spacer material to

the model prior to application of the metal or alloy powder.

118. The method of claim 101 wherein applying the covering material onto the model coated with metal or alloy powder comprises painting the covering material onto the metal powder with a brush.

119. The method of claim 113 wherein coating the covering material with a high temperature refractory material comprises dusting the high temperature refractory material onto the covering material.

120. A dental restoration formed by the process of claim 101.

121. A method for making a dental restoration comprising:
forming a model of one or more teeth;
applying a first layer of a heat-absorbing material to the model;
applying a powder of a first metal or alloy onto the heat-absorbing material;
covering the model coated with the powder of the first metal or alloy with covering material, wherein the covering material comprises a mixture of refractory powder and fibers;
and
sintering the model.

122. The method of claim 121 wherein the fibers are selected from the group consisting of inorganic, organic fibers and mixtures thereof.

123. The method of claim 122 wherein the inorganic fibers are selected from the group consisting of glass, glass-ceramic, ceramic, metal and mixtures thereof.

124. The method of claim 123 wherein the glass fibers are selected from the group consisting of E glass, S glass, AR glass and mixtures thereof.

125. The method of claim 123 wherein the ceramic fibers are selected from the group consisting of alumina, mullite, silica, rock wool and mixtures thereof.

126. The method of claim 123 wherein the metal fibers are selected from the group consisting of steel, aluminum and mixtures thereof.

127. The method of claim 122 wherein the organic fibers are selected from the group consisting of carbon, polyester, polyolefin, polyetheramide, fluoropolymer, polyether, cellulose, phenolic, polyesteramide, polyurethane, epoxy, aminoplastic, silicone, polysulfone, polyetherketone, polyetheretherketone, polyesterimide, polyphenylene sulfide, polyether acryl ketone, poly(amideimide), polyimide fibers and mixtures thereof.

128. The method of claim 121 wherein the fibers range from about 10 nm to about 3 mm in length and from about 5 nm to about 100 microns in diameter.

129. The method of claim 121 wherein the fibers are present in an amount of from about 0.1 to about 25 percent by weight and the refractory powder is present in an amount of from about 75 to about 99.1 percent by weight of the total powder mixture.

130. The method of claim 121 wherein the refractory powder comprises a refractory die material.

131. The method of claim 121 wherein the covering material further comprises a liquid vehicle.

132. The method of claim 131 wherein the liquid vehicle is selected from alcohol and acetone.

133. The method of claim 121 further comprising coating the covering material with a high temperature refractory material.

134. The method of claim 121 wherein the refractory powder comprises silica, leucite or mixtures thereof.

135. The method of claim 134 wherein the silica is selected from the group consisting of quartz, cristobolite and mixtures thereof.

136. The method of claim 130 wherein the refractory die material is selected from the group consisting of gypsum-bonded, phosphate-bonded, ethyl silicate-bonded and mixtures thereof.

137. The method of claim 121 further comprising applying a die spacer material to the model prior to application of the metal or alloy powder.

138. The method of claim 121 wherein applying the covering material onto the model coated with metal or alloy powder comprises painting the covering material onto the metal powder with a brush.

139. The method of claim 134 wherein coating the covering material with a high temperature refractory material comprises dusting the high temperature refractory material onto the covering material.

140. A dental restoration formed by the process of claim 121.